

Dakota, 1 to 23 in.; Nebraska,  $\frac{1}{2}$  to  $8\frac{1}{2}$  in.; Kansas,  $1\frac{1}{4}$  to 3 in.; Colorado, 24 in. on summit of Pikes Peak; Montana, 1 in. at Virginia City; Utah, 3 to 8 in.; Nevada, trace to 7 in.; California, 1 in. at San Geronio, near Visalia at an elevation of 3,000 ft., 20 in., and at 11,000 ft., 108 in.

*Snow from a cloudless sky.*—Milwaukee, Wis., 10th; Burlington, Vt., 19th.

*Floods.*—Los Angeles, Cal., 20th, mountain streams badly swollen from heavy rains, washing away roads and bridges and interrupting rail-road communication for 36 hours. Phoenix, Ariz., 29th, unusually heavy rain-storm, river rose ten feet in two days, causing slight damage. Cape May, N. J., 14th, city flooded by high tides, submerging rail-road tracks, extinguishing locomotives' fires, stopping trains and causing passengers to be brought to the city in boats; two hundred yards of sea-wall washed away. Morgantown, West Va., 25th, the inner wall of canal-lock, near Hoard's Rock, partly carried away by the freshet.

*Droughts.*—San Antonio, Tex., 1st, everything suffering for want of rain; the present drought is unprecedented, its severity causing a check upon immigration. Melissa, Tex., 18th to 23rd, streams mostly dried up and also wells, cisterns and springs.

## RELATIVE HUMIDITY.

The percentages of mean relative humidity for the month range as follows: New England, 73 to 83; Middle Atlantic States, 70 to 84; South Atlantic States, 70 to 87; Eastern Gulf States, 76 to 86; Western Gulf States, 62 to 81; Ohio valley and Tennessee, 66 to 78; Lower Lake region, 72 to 82; Upper Lake region, 69 to 81; Upper Mississippi valley, 66 to 74; Missouri valley, 67 to 94; Red River of the North valley, 98 to 99; Eastern Rocky Mountain Slope, 52 to 69; Texas, 20 at Stockton to 83 at Rio Grande; Western Plateau, 43 to 75; California, 68 to 84; Oregon, 78 to 86. *High stations* report the following averages not corrected for altitude: Pike's Peak, 70.1; Denver, 58.8; Cheyenne, 47.9; Virginia City, 62.8; Santa Fe, 49.9; Mt. Washington, 86.4 per cent.

## WINDS.

The prevailing winds, at the Signal Service stations, are indicated on chart No. II by the arrows, which fly with the wind. The *maximum* hourly velocities, as recorded by self-registers, have been noted in descriptions of the movements of areas of low and high pressure.

*Total Movements of the Air.*—The following are the *largest* total movements recorded in miles at the Signal Service stations during the month: on the summit of Pike's Peak, 20,984 miles; Sandy Hook, 12,066; Thatcher's Island, 11,455; Cape May, 11,387; Indianola, 10,739; Milwaukee, 10,700; Cape Lookout, 10,414; Kitty Hawk, 10,324; Sandusky, 10,012; Barnegat, 10,005; Wood's Holl, 9,930; Cape Henry, 9,710; Cheyenne, 9,502; Fort Sill, 9,144; Eastport, 8,868; Cape Hatteras, 8,843; Breckenridge, 8,728; Dodge City, 8,646. The *smallest* are: Deadwood, 1,740 miles; Visalia, 1,769; La Mesilla, 2,138; Augusta, 2,194; Lynchburg, 2,362; Uvalde, Tex., 2,794; Nashville, 2,817; Baltimore, 3,005; Silver City, N. M., 3,080; Virginia City, 3,078; La Crosse, 3,156; Los Angeles, 3,387; Savannah, 3,500; Eagle Pass, Tex., and Salt Lake City, 3,604; Fort Buford, Dak., 3,606; Laredo, 3,644; Boise City, 3,707; San Antonio, Tex., 3,727; Springfield, Mass., 3,811; Charlotte, N. C., 3,946.

*Local Storms.*—Winnemucca, Nev., 16th, p. m., a severe whirlwind passed from southwest to northeast, causing considerable damage, track one mile wide and lasting fifteen minutes. Colorado Springs, Col., 28th, violent gale from the west, destroying fences, signs and buildings; at a point 12 miles north of station a parlor car and one engine were lifted from the track and thrown down an embankment. Renick, Randolph Co., Mo., 9th, a severe tornado passed near the town at about 4 p. m., causing great havoc. The storm first appeared in the shape of a dense rolling cloud, hiding the sun and making it appear for miles as dark as night. The first warning of the tornado was signaled by a little black speck to the south-east of the town, which gradually grew larger until it seemed to cover the whole heavens, when the wind increased to hurricane violence. Many buildings were literally torn to pieces; fences and grain-stacks scattered in every direction, and portions of the railroad track torn up and carried great distances. Several animals were killed outright and many persons badly injured. The track of the storm was very narrow and the storm lasted but a few moments. Parker's station, Scott Co., Mo., 10th, a severe wind-storm passed over this point between twelve and one o'clock p. m., destroying several large sheds, each 100 feet in stored length, with staves, scattering the material in every direction. Two buildings were unroofed, large trees were uprooted and many fences and outbuildings entirely destroyed. Burlington, Vt., 24th, very severe wind-storm, snow piled in heavy drifts, several sheds and other buildings blown down and much damage to other property.

*Sand-storms.*—Coleman, Tex., 4th and 9th; Fort Garland, Col., 8th; Yuma, Ariz., 24th and 25th—very violent.

## VERIFICATIONS.

*Indications.*—The detailed comparison of the tri-daily indications for December, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 85.7 per cent. The percentages for the four elements are: Weather, 88.1; Direction of the Wind, 81.5; Temperature, 87.7; Barometer, 85.4 per cent. By geographical district they are for New England, 89.4; Middle States, 84.7; South Atlantic States, 85.1; Eastern Gulf States, 85.9; Western Gulf States, 85.6; Lower Lake region, 87.8; Upper Lake region, 84.4; Tennessee and the Ohio valley, 83.9; Upper Mississippi

valley, 86.2; Lower Missouri valley, 88.9; Northern Pacific coast region, 87.5; Central Pacific coast region, 86.6; Southern Pacific coast region, 88.3 per cent. There were 16 omissions to predict out of 3,813, or 0.42 per cent. Of the 3,797 predictions that have been made, 69, or 1.82 per cent, are considered to have entirely failed; 128, or 3.37 per cent, were one-fourth verified; 539, or 14.19 per cent, were one-half verified; 429, or 11.30 per cent, were three-fourths verified; 2,732, or 69.32 per cent, were fully verified, so far as can be ascertained from the tri-daily weather maps.

*Cautionary Signals.*—270 Cautionary Signals were displayed during the month, of which 223, or 82.5 per cent., were justified by winds of 25 miles per hour or over at, or within a radius of 100 miles of the station. 82 Off-shore Signals were displayed, of which 63, or 76.8 per cent, were fully justified; 72, or 87.8 per cent, were justified as to direction; 67, or 81.1 per cent, were justified as to velocity; and 6, or 7.3 per cent, were not justified either as to direction or velocity. 43 of the Off-shore were changed from Cautionary. 309 Signals of both kinds were displayed, of which 251, or 81.2 per cent, were fully justified. The above does not include signals ordered for 50 display stations, where the velocity is only estimated. 46 cases of winds of 25 miles and over per hour, from scattering stations, were reported, and for which signals had not been ordered. One signal was reported late.

## NAVIGATION.

In the table on the right-hand side of chart No. III are given the highest and lowest readings of the Signal Service river-gauges for the month, with the dates of the same. The *Savannah*, at Augusta, changed but little previous to the 13th, then rose quite rapidly during the 15th, and reached its maximum of 30 feet on the 16th. During the remainder of the month it fell quite steadily. The *Red* continued nearly stationary during the first half of the month at a little less than 3 feet below the bench mark, (previous low water mark,) at Shreveport, then slowly rose, reaching the bench-mark night of the 18th, and its maximum height at the close of the month. In the *Arkansas*, at Little Rock, the oscillations have been slight and gradual, excepting a rise of nearly 5 feet on the 25th and 26th. The *Tennessee*, at Chattanooga, changed but little previous to 11th. During that day and the following it rose over 10 feet; on the 15th and 16th nearly 6 feet; 23rd to the 26 nearly 15 feet. At Nashville, the *Cumberland* rose over 8 feet from the 5th to 7th; fell over 5 feet to the 9th; rose over 17 feet by the 12th, and 7 more by the 16th; fell over 21 feet up to the 22nd; rose 22 feet by the 29th, when it reached its maximum. In the *Ohio* the changes were unimportant, excepting a slow increase of depth of water, until the 24th and 25th, when the river rapidly rose at Pittsburgh and Cincinnati; the 26th to 28th, from Louisville down. For the *Missouri* the changes are of little interest. At Yankton the river was frozen after the 2nd; at Omaha, after the 10th; at Leavenworth, after the 12th. In the *Mississippi*, above Cairo, the changes were slight and gradual. The river was frozen at St. Paul after the 7th; at La Crosse, after the 11th; at Dubuque, after the 16th; at Davenport, after the 18th; at Keokuk, after the 24th. At Cairo the river slowly rose to 30 feet by the 17th; fell to 25 feet on 23rd; then rose to its maximum at close of month. At Memphis it rose to 25 feet by the 20th; fell to less than 21 feet by 25th; then rose to nearly 27 feet on the 31st. At Vicksburg it steadily rose to over 30 feet by 25th, and remained nearly stationary thence to end of month. At New Orleans there was quite a steady and slow rise.

*Ice in Rivers and Harbors.*—The following notes on the formation of ice are of interest: The *Columbia river*.—At Umatilla, Or., closed to navigation on the 19th. The *Missouri*.—At Plattsburgh, Neb., ice gorged at rail-road pile bridge and froze solid on the 10th; 18 to 20 inches thick on the 31st. At Leavenworth, Kan., on the 11th and 12th, floating ice; 13th, ice gorged; 14th, river frozen over. At Kansas City, Mo., floating ice from 11th to 14th, river closed on 15th. Creswell, Kan., 12th, creeks frozen over. *Platte river*.—Closed with ice, and teams crossing on the 13th. The *Mississippi*.—At St. Paul, Minn., frozen over on the 8th. At LaCrosse, Wis., closed by ice on the 12th. At Dubuque, Ia., free of ice on the 5th; gorged on the 13th; frozen over on the 17th, passengers and teams crossing. At Davenport, Ia., floating ice on 1st, 11th, 12th, 15th to 18th; last boat of season passed down on the 14th; navigation closed on the 17th; frozen over on the 19th; vehicles crossing on ice 22nd. At Burlington, Ia., floating ice on the 1st, 2nd, 10th, 12th to 15th; navigation closed on the 10th; nearly frozen over on the 16th; frozen over on the 18th; people crossing on the ice on the 19th; teams crossing on the 20th. At Muscatine, Ia., frozen over on the 18th; teams crossing on 22nd. At Keokuk, Ia., floating ice from the 11th to the 25th, inclusive; river closed on the 25th; ice broken up on the 28th; navigation closed on the 11th. At St. Louis, Mo., floating ice on the 16th and 17th; 18th, navigation suspended; 21st, heavy; 22nd, 24th, 25th; 26th, gorged near bridge; 27th, 28th; gorged at St. Charles, 29th; river nearly clear on 30th. At Cairo, Ill., floating ice from 18th to 31st; very heavy from 26th to 31st, causing entire obstruction of navigation. *Des Moines river*.—At Des Moines, Ia., closed by ice on the 13th. At Boonesboro, Ia., closed by ice strong enough for teams to cross on the 10th. *Rock river*.—At Rockford, Ill., frozen over solid on the 12th; Lyndon, Ill., 12th, river closed with ice above the dam; 25th, closed with ice the below dam. *Skunk river*.—Ames Ia., river frozen over during the month. Tabor, Ia., 31st, ice in creeks fourteen inches thick. *Cottonwood river*.—Creswell, Kan., 26th, river and neighboring creeks frozen over. Wellington Kan., 31st, ice in creeks six inches thick. Cedar Vale, Kan., 12th to 31st, Caua creek frozen over. The *Ohio*.—At Cairo, Ill., drift wood in river from the 7th to the 17th, and from the 28th to the 31st. At Cincinnati, full of floating ice on the 27th. Miami canal closed by ice on the 26th. *Hudson river*.—At Garrison's, N. Y., navigation entirely suspended on the 31st. *Susquehanna*.—At Catawissa, Pa.,